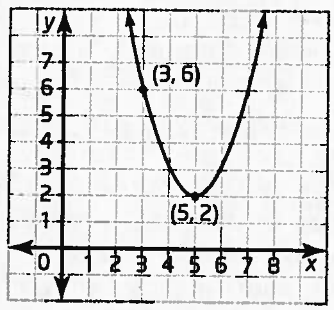
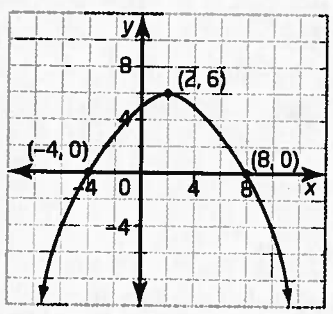
Chapter 4 Practice Test

1. Sketch a graph of each parabola. Label the coordinates of the vertex and the equation of the axis of symmetry.
   a) $y = x^2 - 6$
   b) $y = 2(x - 5)^2$
   c) $y = -\frac{1}{3}(x + 3)^2 + 4$

2. Sketch a graph of each relation. Label the x-intercepts and the vertex.
   a) $y = (x - 6)(x + 2)$
   b) $y = -4(x - 1)(x - 9)$

3. Determine an equation to represent each parabola.
   a)


   b)


4. Evaluate.
   a) 4^0
   b) 5^{-1}
   c) $(-3)^{-3}$
   d) $\left(\frac{3}{4}\right)^{-2}$

5. The table shows the length of a spring under a specific load.

Load (kg)	Length (cm)
0	12.0
1	12.6
2	13.8
3	15.6
4	18.0
5	21.0
6	24.6

   a) Use finite differences to determine whether this is a quadratic relation.
   b) Make a scatter plot of the data. Draw a curve of best fit.
   c) Use your curve of best fit to predict the length of the spring under a load of 8 kg.

6. Board-feet are used to measure the total length, in feet, of boards that are 1 inch thick and 1 foot wide that can be cut from a tree to make lumber. You can use the equation $l = 0.011a^2 - 0.68a + 13.31$ to estimate the number of board-feet available in a certain type of tree, where l is the number of board-feet and a is the age, in years, of the tree.
   a) What is the approximate number of board-feet available to be cut from a 40-year-old tree?
   b) What is the approximate number of board-feet available to be cut from a 75-year-old tree?
   c) Why does the number of board-feet increase in a quadratic manner as a tree ages?
   d) Who would be interested in knowing this type of information? Explain.

7. The St. Louis Gateway Arch in St. Louis, Missouri, was built in 1965 and was designed as a catenary, which is a curve that approximates a parabola. The arch is 192 m wide and 192 m tall.

a) Sketch a graph of the arch that is symmetrical about the y-axis.

b) Label the x-intercepts and the vertex.

c) Determine an equation to model the arch.

8. When a car is travelling at a given speed, there is a minimum turn radius it can safely make. A particular car's minimum radius can be calculated by $r = 0.6s^2$, where s is the speed, in kilometres per hour, and r is the turning radius, in metres. If the car uses tires with better grip, how does this affect the equation? Justify your response.

9. The maximum viewing distance on a clear day is related to how high you are above the surface of Earth. This relationship can be approximated by the formula $h = \frac{3}{40}d^2$, where d is the maximum distance, in kilometres, and h is your height, in metres, above the ground.

a) How high do you need to be in order to see a distance of 25 km?

b) How would the formula change if you were standing on a 20-m cliff?

10. A volleyball's height, h, in metres, above the ground after t seconds is modelled by the relation $h = -4.9t^2 + 5t + 2$.

a) Graph the relation.

b) What is the h-intercept? What does it represent?

c) How long will it take the volleyball to hit the ground? What feature on the graph models this? Explain your answer.

11. An ant colony has 5000 ants on July 1 and doubles every year. This can be expressed as $N = 5000 \times 2^t$, where N represents the number of ants and t represents time, in years.

a) Find the number of ants after 2, 3, 4, and 5 years.

b) What does $t = 0$ represent in this situation? What does $t = -2$ represent?

c) When were there 625 ants? Explain.

12. Use Technology The approximate cost of operating a certain car at a constant speed is given by the formula $C = 0.006(s - 50)^2 + 20$, for $10 \le s \le 130$, where s is the speed, in kilometres per hour, and C is the cost, in cents per kilometre. Use a graphing calculator to compare the operating costs, at different speeds, to those of a second vehicle with formula $C = 0.008(s - 55)^2 + 15$.

Achievement Check

13. a) Graph the following relations by developing a table of values and plotting points. Then, find the first and second differences.

$y = x^2 - 4x$

$y = x^2 - 4x + 5$

$y = x^2 - 4x - 2$

b) Examine each graph and use its properties to write an equation in the form $y = (x - h)^2 + k$.

c) What conclusions can you make about the relation $y = x^2 - 4x + c$ for different values of c?